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Drawing attached.

COMPLETE SPECIFICATION.

"IMPROVEMENTS IN OR RELATING TO FOOTWEAR AND TO METHODS
AND MEANS FOR MANUFACTURING SAME."

The following statement is a full description of this invention,
including the best method of performing it known to us:-

This invention relates to footwear and to methods and means for
manufacturing footwear. The invention is applicable to all types of foot-
wear, for instance to shoes, slippers, boots, bootees and sandals. In
the further description of the invention and in the appended claims the
term "shoes" will therefore be used to refer to any type of footwear.

Shoes normally include two main portions, namely a sole, the
general purpose of which is to protect the lower part of the foot of the
wearer, and an upper, the general purpose of which is to protect the upp-
er part of the foot. In some shoes a heel is provided which may be either
integral with or attached to the sole. Hereinafter the word "sole" will
be used to include the heel where provided.

The object of the invention is to provide shoes, and methods and
means for manufacturing shoes, which give additional protection and/or
support to the foot without any appreciable increase in the manufacturing
costs.

The invention consists of a shoe having an upper and a moulded sole bonded thereto,, said sole having an upwardly turned extension thereof proceeding from the main portion of the sole along the line of the bottom of the upper, said extension forming a facing to the upper, and at least the main portion of the sole having been formed in situ on the upper and simultaneously bonded thereto.

More particularly, the invention consists of such a shoe in which the sole is formed integrally with the upwardly turned extension thereof, the extension having also been formed in situ on the upper and simultaneously bonded thereto.

It is found that a shoe constructed in accordance with this invention, more particularly such a shoe when produced by one or other of the methods hereinafter defined and with the use of a mould having the constructional features hereinafter set forth, can be manufactured very economically as regards cost of labour involved and installation and maintenance costs of apparatus used. This in a shoe which is so constructed the sole and its upwardly turned extension are perfectly bonded to the upper without the need for any stitching, stapling or similar securing means involving the use of a sewing, stapling or like machine. Further, owing to the absence of seams along lines of junction of the sole and its extension to the upper the appearance of the finished shoe is enhanced as compared with a shoe having a stitched on sole and extension; also a more watertight shoe is provided and one in which the sole and its extension remain united to the upper substantially indefinitely, their union not being dependent on the durability or otherwise of stitches, which is usually a very uncertain factor, more especially in the case of child's shoe.

The extension of the sole may extend completely therearound and if it extends only along a portion of the edge of the sole its location therealong may be any desired location or locations according to the design of the shoe or the functional requirements of the extension. Thus it may be located at the heel end and/or the toe end of the shoe, or at one or both of the sides of the shoe. The invention more especially contemplates, however, a construction in which the extension is located at the heel end of the sole and forms a covering for the rearmost part of the quarters of the upper.

The extension of the sole may extend in the upward direction to the line of the top of the upper, or if desired to a position above or below this line. Its upper edge may be flush with the line of the top of the upper or spaced from and parallel thereto. Alternatively said upper edge may have a shape different from the shape of the line of the top of the upper.

The invention further consists of a method of making a shoe having the characteristics set forth above, which consists in forming an upper,

lasting the upper, placing in an open mould of a shape to form both the main portion of the sole and also the extension thereof in a single moulding operation common to both of these parts, a charge of material to form said main portion and extension, said charge being mouldable when in a heated condition and being capable of assuming a state of permanent set in the moulded shape upon re-cooling, and at least a part of the charge, located in a layer thereof occupying a position in the charged mould nearest to the open side thereof, being formed of a material which has the additional property of becoming adhesive when heated, applying the lasted upper to the charged mould, the form of the mould being such that it is completely closed by the lasted upper when the latter is in applied position, and heating the charge in the mould, with the lasted upper firmly held in said position thereon, to effect simultaneous moulding and bonding of the sole and its extension to the upper.

More particularly, the invention consists of such a method when applied to the manufacture of a shoe of which the sole, or at least a layer thereof adjacent the upper, is composed of rubber, the charge, or part thereof, aforesaid being formed of a vulcanisable rubber compound.

According to an alternative form of the invention, the upper of the shoe, in position on a last, is applied to a mould in which the main portion of the sole is formed in integral connection with a pre-formed extension of the sole hereinbefore referred to previously attached to the upper, e.g. by cementing or stitching, in such a position thereon as to become united integrally to the main portion of the sole during the formation thereof in the mould.

The invention further consists of a mould for use in carrying the first of the methods above defined into effect, said mould comprising structure providing a mould cavity of such shape as to form in conjunction with a lasted upper placed over it a closed space having the shape of a shoe sole formed with an integral extension thereof as hereinbefore referred to extending upwardly from the sole along at least a portion of the edge thereof.

According to one general form of the invention, the said structure of the mould, providing a mould cavity, may comprise a base, a mould element carried thereon which defines the tread surface of the main portion of the sole and a frame, also carried on said base, which defines the edge of said main portion and also the outer face and lateral edges of the extension of the sole.

With such a construction the frame may be divided into a plurality of mutually complementary sections which are readily separable from one another to facilitate removal of the sole from the mould, said sections being preferably mounted for guided movement relatively to the base to

and from the positions they occupy during a moulding operation, from and to respectively positions in which they are parted from one another.

Any material or combination of materials capable of being moulded in a mould may be used to form the sole and its upward extension, provided the material or combination of materials possess the property of becoming firmly bonded to the upper under the conditions of the moulding operation. Suitable materials include leather, rubber, plastics and felt. The term "rubber" as used herein includes both natural rubber and synthetic rubber. Suitable plastics for use in the invention include polyvinyl chloride, polythene, polyethylene and polystyrene.

The sole may have a tread layer which is more resistant to wear than the remainder of the sole, in which case it may consist of a solid-rubber tread, a solid-rubber or sponge-rubber compound middle sole and a felt filler, or alternatively of a thin leather tread or outsole and a sponge-rubber middle sole, the leather and sponge-rubber being bonded by vulcanisation during the operation of forming the sole in the mould; or in further alternative it may consist of a relatively thick leather outsole and a thin rubber middle sole, the two parts of the sole being bonded by vulcanisation during the formation of the sole in the mould.

The sole and/or its upward extension may, however, be composed of a single material, e.g. a vulcanisable rubber-based or plastic-based compound, in contrast to being composed of two or more different materials as in the instances above visualised.

The sole and/or its upward extension may also be formed from a single piece of material, e.g. crude or semi-cured rubber-based or plastic-based compound, capable of being moulded to the required shape, or of two or more pieces of such material, the pieces being, if desired or if necessary, cemented, sewn or otherwise secured together so as to form a unitary member before being placed in the mould.

The moulding operation in the formation of the sole, with or without its upward extension, may be effected under pressure moulding conditions or under non-pressure moulding conditions. It may also be performed by extrusion moulding, by which is meant moulding in a mould into which the rubber, plastic or other material to be moulded is injected into the mould under pressure.

The invention will now be further described by way of example with reference to the accompanying drawings.

In these drawings:

Figure 1 is a perspective view of one form of mould in accordance with this invention, the Figure showing also a lasted upper in moulding position in the mould;

Figure 2 is a perspective view of the base element of the mould

shown in Figure 1;

Figures 3 and 4 are perspective views of the frame element of the mould, Figure 3 showing the frame in the closed (moulding) condition thereof and Figure 4 showing the frame in the open condition thereof;

Figure 5 is a fragmentary plan view of the mould shown in Figures 1 to 4, illustrating certain parts hereinafter more particularly described;

Figures 6 and 7 are respectively a side elevation and plan view of a mould in accordance with the invention in the form thereof in which the portions of the frame which define the outer face and lateral edges of the extension of the sole are formed non-integrally with the portions which define the edge of the main portion of the sole;

Figure 8 is a side elevational view, partly in section, of a mould in accordance with the invention in the form thereof in which the extension of the sole is preformed, it being understood that this Figure, and similarly the Figures 6 and 7, are largely diagrammatic; and

Figure 9 is a perspective view of a shoe which has been manufactured in accordance with the invention.

The shoe illustrated in Figure 9 comprises an upper 1 and a moulded sole 2 having at the heel end thereof an upwardly directed integral extension 3.

The shoe illustrated has been produced with the use of the mould illustrated in Figures 1 to 5. This mould comprises a base, generally marked B, and a frame, generally marked F, in Figure 1.

The base consists of a bottom plate 4 and a top plate 5. The top plate is mounted upon and firmly affixed to the bottom plate and it carries, upstanding from it, a mould element 6 which defines the tread surface of the main portion of the sole.

The frame consists of two jaw-like members 7, 8 articulated to one another for scissor-fashion mould opening and closing movement, through the intermediary of a link plate 9 to which they are pivotally connected by pins 10, 11.

The frame is therefore divided lengthwise into two mutually complementary sections which are readily separable from one another to facilitate removal of the shoe from the mould.

Each of these sections carries a mould surface 12 designed to form the edge of the main portion of the sole and a continuation 13 of this surface designed to form the outer face and lateral edges of the upward extension 3 (Figure 9) of the sole. The precise shape and position of these surfaces 12, 13 is such that when the frame is closed and in moulding position (Figure 1) on the base B the surfaces 12, 13 are mutually complementary to the surface 15 of the mould element 6, in the sense

that upon disposing a lasted upper of the shoe to be produced in moulding position (Figure 1) over the assembled mould, the surfaces 12, 13 and 15 and the underside of the lasted upper define together a closed space conforming exactly to the designed shape of the sole and its upward prolongation 3.

The closed frame is located in the assembled mould, relatively to the base of the mould, by the sides of the mould element 6, which for this purpose exactly fit the inner surfaces of the sides of the members 7, 8 of the frame.

The frame is locked in the closed (moulding) condition by a toggle mechanism consisting of a pair of links 16, 17 pivoted to the members 7, 8 by pins 18, 19 and pivoted to one another by a third pin 20 at the free end of the link 17, the arrangement being such that when the links 16, 17 are in the positions in which they appear in Figure 5 the frame is in the open condition, and when the link 16 is brought round to the dotted line position the frame is in a condition (the closed condition) in which the two members 7, 8 are firmly clamped together about the mould element 6 of the base of the mould, with a downward prolongation of the pin 20 held by toggle action of the links, at the bottom of a slot 21 in the jaw 7 into which it has passed during the movement of the link 16 to the dotted line position.

Figure 1 shows the parts (assembled and closed mould, and lasted upper) in the positions they occupy during a moulding operation, the upper being marked U and the last L.

It will be understood that upon assembling and closing the mould the latter is filled with its charge of vulcanisable sole-forming material prior to the operation of disposing the lasted upper in moulding position over the mould.

In the usual case, of use of a heat vulcanisable material to form the charge of the mould, the mould and/or the last would be heated during the moulding operation. For this purpose the base B, and similarly the last L, incorporate electric heating elements (not shown), which may be of any suitable type and disposition. The elements of the last are fed with current by way of supply leads 22 (Figure 1) and those of the base by leads which connect with plug terminals 23 (Figure 2).

As will be seen, the mould, of the above description, has in the side elevation thereof a tilted attitude. This is to facilitate the operation of lowering the lasted upper into moulding position over the closed and filled mould for the purposes of the moulding operation and the subsequent operation of raising the lasted upper from the opened mould, with the sole in bonded attachment to it, after the moulding operation, the path of movement of the last in these operations being vertical, or substantially so, and the shape of the shoe being such that in the profile of the shoe the line of

the heel end of the upper of the shoe slopes forwardly somewhat, as shown for example in Figures 8 and 9.

The last is raised and lowered by means (not shown) having an operative connection to the last through the intermediary of a lug 24 thereon. These means may be manual or power operated, e.g. in the latter case, an hydraulic ram. In either case they may form a component part of the apparatus in which the mould of the invention is used, which apparatus, as regards the general features thereof, may take any convenient form.

Referring now to the embodiment of the invention illustrated in Figures 6 and 7, the mould used in this embodiment comprises a base plate 25 upon which are mounted two jaw-like mould sections each formed of a first portion 26 and a second portion 27, the latter mentioned portion being hinged to the first portion by a pin 28 for arcuate movement relatively to the corresponding first portion from a substantially horizontal position (in which it appears in Figure 7) to a substantially vertical position (in which it appears in Figure 6). The two sections are pivotally mounted for mould opening and closing movement scissor fashion about the axis of a pin 29 upstanding from the base plate 25.

The portions 26 of the sections are formed with mould cavities 30 of a shape corresponding, when the sections are in their mould closed position, exactly to the shape of the main portion of the sole of the shoe. The portions 27 are similarly formed with mould cavities 31 of a shape corresponding, when the sections are in position, exactly to the shape of the upward extension of the sole.

During the operation of filling the mould with its charge of sole forming material, and similarly during the moulding operation, the sections of the mould are of course in their mould closed positions, being firmly clamped together therein (by means not shown), the portions 27 of the sections occupying the substantially horizontal position during the first of said operations and the substantially vertical position during the moulding operation.

Upon completion of the moulding operation the mould is opened by hinging movement of the sections about the axis of the pin 29, preceded if necessary by hinging movement of the portions 27 about the axes of the pins 28 away from the substantially vertical (moulding operation) position of the portions. The shoe, with the sole and its upward extension firmly bonded by vulcanisation to the upper, can now be raised clear of the mould as in the previously described embodiment.

In the embodiment illustrated in Figure 8, the mould comprises a base 32 carrying a mould element 33 shaped to form the tread surface of the sole and a frame 34 shaped, as regards the inner periphery of the

frame, to form the edge of the sole.

The frame may be in one piece or in two or more pieces. For example, it may be in two mutually complementary sections mounted for guided (e. g. pivotal) movement relatively to the base 32 to and from a mould closed position in which the sections are firmly clamped together about the mould element 33, from and to respectively a mould open position in which the sections are parted slightly to facilitate the operation of removing the shoe from the mould.

As already remarked, the embodiment illustrated in Figure 8 is one in which the upward extension of the sole, marked 35 in the Figure, is pre-formed and attached to the upper prior to the lasting thereof and therefore prior to the moulding operation. The extension may be a moulding. Alternatively it may be extruded, stamped or cut to shape. In either case, it is preferably of such a shape as to enable a narrow marginal portion 35 of the extension to encroach slightly into the interior space of the mould so as to be overlapped or surrounded, wholly or partially, by the material of the main portion 36 of the sole during the moulding operation. In this way an integral connection is formed during the moulding of the sole as between the main portion thereof and the prolongation.

In a case where only the main portion of the sole is formed and bonded to the upper in a mould, the upward extension of the sole being formed and applied to the upper separately, the extension may be stitched, sewn, cemented or otherwise attached to the heel end of the main portion of the sole, instead of being integrally bonded thereto during the formation of the main portion and its bonding to the upper in the mould as in the embodiment of the invention illustrated in Figure 8.

In all of the embodiments where a lasted upper is used, the lasting of the upper may be performed in any conventional manner, e. g. by string lasting or slip lasting.

The form of the sole and its upward extension may vary widely to suit, for example, the design or wearing requirements of the shoe. Inter alia, the upward extension may form a relatively sharp angle with the main portion of the sole along the line of junction therewith, as regards either the inner profile or the outer profile, or both, of the vertical section through the shoe. Alternatively said inner profile or said outer profile, or both, may be well rounded along said line of junction.

A shoe manufactured according to this invention by any of the methods described using a mould for the formation of the sole and its upward extension, or as the case may be the main portion only of the sole, acquires the exact shape of the mould and requires no trimming or finishing.

The shoe of this invention has the following advantages: Firstly, the upward extension of the sole affords additional support, over that available in conventional footwear, to the foot and ankle of the wearer, which is particularly important in the case of children's footwear, having regard to the child's incompletely developed bone, flesh and muscle structure. Secondly, the presence of the upward extension in the shoe increases the possible range of design and ornamentation of footwear. Thirdly, better footwear can be made more economically.

Various modifications are possible; for example the mould frame sections of the form of mould illustrated in Figures 1 to 5 and Figure 8, and similarly the mould sections of the form of mould illustrated in Figures 6 and 7, may be movable towards and away from one another on slides instead of being pivotally movable. In the same way the portions of the mould sections which form the upward extension of the sole, in the case of the form of mould illustrated in Figures 6 and 7, may be mounted on slides instead of being hinged to the portions of the sections which form the main portion of the sole. Also the mechanism used for opening and closing the mould sections (Figures 6 and 7) or mould frame sections (Figures 1 to 5 and Figure 8) may take any other convenient form, the particular form described and illustrated, involving the use of a system of toggle action links, representing only one possible and generally preferred form of the invention. According to another possible modification, the frame element of the mould used for carrying the invention into effect may be formed in one piece, or in two pieces only, one for the formation of the main portion of the sole and the other for the formation of the upward extension of the sole, in contrast to being of a longitudinally divided construction as in the forms of the invention illustrated.

The claims defining the invention are as follows:-

1. A shoe having an upper and a moulded sole bonded thereto, said sole having an upwardly turned extension thereof proceeding from the main portion of the sole along the line of the bottom of the upper, said extension forming a facing to the upper, and at least the main portion of the sole having been formed in situ on the upper and simultaneously bonded thereto. (19th July, 1957).

2. A shoe according to Claim 1, wherein the main portion of the sole is formed integrally with the extension, the latter having also been formed in situ on the upper and simultaneously bonded thereto. (19th July, 1957).

3. A shoe according to Claim 1 or Claim 2, wherein the extension is located at the rear end of the sole and forms a covering for the rearmost part of the quarters of the upper. (19th July, 1957).

4. A shoe according to any one of the preceding claims, wherein at least the main portion of the sole is composed, at least as regards a layer thereof adjacent the upper of the shoe, of rubber. (19th July, 1957).

5. A method of making a shoe of the construction specified in Claim 2 or Claim 3 or 4 regarded as appended to Claim 2, which method consists in forming an upper, lasting the upper, placing in an open mould of a shape to form both the main portion of the sole of the shoe and also the upwardly turned extension thereof in a single moulding operation common to both of these parts, a charge of material to form said main portion and extension, said charge being mouldable when in a heated condition and being capable of assuming a state of permanent set in the moulded shape upon re-cooling, and at least a part of the charge, located in a layer thereof occupying a position in the charged mould nearest to the open side thereof, being formed of a material which has the additional property of becoming adhesive when heated, applying the lasted upper to the charged mould, the form of the mould being such that it is completely closed by the lasted upper when the latter is in applied position, and heating the charge in the mould, with the lasted upper firmly held in said position thereon, to effect simultaneous moulding and bonding of the sole and its extension to the upper. (19th July, 1957).

6. A mould for use in carrying into effect the method claimed in Claim 5, said mould comprising structure providing a mould cavity of such shape as to form in conjunction with a lasted upper placed over it a closed space having the shape of a shoe sole formed with an integral upwardly turned extension thereof proceeding from the main portion of the sole along at least a portion of the edge thereof. (19th July, 1957).

7. A mould for use in carrying into effect the method claimed in Claim 5, said mould comprising structure providing a mould cavity of such shape as to form in conjunction with a lasted upper placed over it a closed space having the shape of a shoe sole formed with an integral upwardly turned extension thereof proceeding from the main portion of the sole along a portion of the edge of the sole at the rear end thereof. (19th July, 1957).

8. A mould according to Claim 6 or Claim 7, wherein said structure comprises a base, a mould element carried thereon which defines the tread surface of the main portion of the sole and a frame, also carried on said base, which defines the edge of said main portion and also the outer face and lateral edges of the upwardly turned extension of the sole. (19th July, 1957).

9. A mould according to Claim 8, wherein the frame is divided longitudinally thereof into two single-piece mutually complementary sections which are readily separable from one another to facilitate removal of the sole from the mould, said sections being mounted for guided movement relatively to the base to and from the positions they occupy during a moulding operation, from and to respectively positions in which they are parted from one another. (2nd July, 1958).

10. A mould according to Claim 6, wherein said structure includes a plurality of mutually complementary sections which are readily separable from one another to facilitate removal of the sole from the mould and which, considered collectively, carry both the portions of the mould cavity surface which form the tread surface of the sole and also the portions of the mould cavity surface which form the edge of the main portion of the sole and the outer face and lateral edges of the upwardly turned extension of the sole. (2nd July, 1958).

11. A mould according to Claim 10, wherein the sections are mounted for guided movement to and from the positions they occupy during a moulding operation, from and to respectively positions in which they are parted from one another. (2nd July, 1958).

12. A mould according to Claim 7, wherein said structure includes a base and two two-piece complementary sections which are readily separable from one another to facilitate removal of the sole from the mould, the line of division of the mould into said sections extending lengthwise thereof, each section comprising a piece which carries a corresponding part of that portion of the mould cavity surface which forms the tread surface of the sole and the edge of the main portion of the sole and a piece which carries a corresponding part of that portion of said surface which forms the outer face and lateral edges of the upwardly turned extension of the sole, the two sections being mounted for guided movement relatively to the base to and from the positions they occupy during a moulding operation, from and to respectively positions in which they are parted from one another and the second piece of each section being

pivotally mounted upon the first piece for movement relatively thereto away from the position it occupies during a moulding operation while the first piece is in the position it occupies during a moulding operation. (2nd July, 1958).

13. An apparatus for the manufacture of a shoe of the construction specified in Claim 3 by a method as specified in Claim 5, said apparatus comprising a mould of the construction specified in Claim 7, a last for the upper of the shoe, said last being designed for co-operation with said mould, and means for raising and lowering the last from and into moulding position relatively to the mould, the mould having in the side elevation thereof a tilted attitude to facilitate the removal of the shoe, in position on the last, from the mould. (19th July, 1957).

14. A method of making a shoe of the construction specified in Claim 1, which method consists in forming an upper, pre-forming a member to constitute the upwardly turned extension of the sole, attaching the pre-formed member to the upper of the shoe, lasting the upper with the pre-formed member attached thereto, placing in an open mould of a shape to form the main portion of the sole a charge of material to form said main portion, said charge being mouldable when in a heated condition and being capable of assuming a state of permanent set in the moulded shape upon re-cooling, and at least a part of the charge, located in a layer thereof occupying a position in the charged mould nearest to the open side thereof, being formed of a material which has the additional property of becoming adhesive when heated, applying the lasted upper to the charged mould, the form of the mould being such that it is completely closed by the lasted upper and the part of the pre-formed member which is adjacent the mould when the lasted upper is in applied position, the pre-formed member occupying such a position on the upper as to become united integrally to the main portion of the sole during the formation thereof in the mould, and heating the charge in the mould, with the lasted upper firmly held in said position thereon, to effect simultaneous moulding and bonding of the main portion of the sole to the upper. (2nd July, 1958).

15. A method of making a shoe having a moulded sole from which an upwardly turned extension thereof proceeding from the main portion of the sole along the line of the bottom of the upper, said extension being located at the rear end of the sole, forms a facing to the upper covering the rearmost part of the quarters thereof, substantially as hereinbefore described with reference to Figures 1 to 5 of the accompanying drawings. (2nd July, 1958).

16. A method of making a shoe having a moulded sole from which an upwardly turned extension thereof proceeding from the main portion of the sole along the line of the bottom of the upper, said extension being located at the rear end of the sole, forms a facing to the upper covering the rearmost part of the quarters thereof, substantially as hereinbefore described with reference to Figures 6 and 7 of the accompanying drawings. (2nd July, 1958).

17. A method of making a shoe having a moulded sole from which an upwardly turned extension thereof proceeding from the main portion of the sole along the line of the bottom of the upper, said extension being located at the rear end of the sole, forms a facing to the upper covering the rearmost part of the quarters thereof, substantially as hereinbefore described with reference to Figure 8 of the accompanying drawings. (2nd July, 1958).

18. A mould for use in the method claimed in Claim 15, constructed and arranged substantially as hereinbefore described with reference to Figures 1 to 5 of the accompanying drawings. (2nd July, 1958).

19. A mould for use in the method claimed in Claim 16, constructed and arranged substantially as hereinbefore described with reference to Figures 6 and 7 of the accompanying drawings. (2nd July, 1958).

20. A mould for use in the method claimed in Claim 17, constructed and arranged substantially as hereinbefore described with reference to Figure 8 of the accompanying drawings. (2nd July, 1958).

21. A shoe having a moulded sole from which an upwardly turned extension thereof proceeding from the main portion of the sole along the line of the bottom of the upper, said extension being located at the rear end of the sole, forms a facing to the upper covering the rearmost part of the quarters thereof, when produced by a method as claimed in any one of the Claims 5, 14 or 15, or with the use of a mould as claimed in any one of the Claims 6, 7, 8, 9, 10, 11, or 12. (2nd July, 1958).

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211,126	23,581/56	44.0; 44.1; 44.3
140,851	18,665/48	44.0; 44.1; 44.3
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